

INCH-POUND

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## PERFORMANCE SPECIFICATION

### FILTER-COALESCEER ELEMENT, FLUID PRESSURE

This specification is approved for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers filter-coalescer elements for use in filter-separator vessels for handling liquid petroleum fuels (see 6.1).

#### 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirement documents cited in sections 3 and 4 of this specification, whether or not they are listed.

##### 2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Tank-Automotive and Armaments Command, ATTN: AMSTA-TR-D/210, Warren, MI 48397-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 4330

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## SPECIFICATIONS

### DEPARTMENT OF DEFENSE

MIL-PRF-25017 - Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble (Metric).

## STANDARDS

### DEPARTMENT OF DEFENSE

MIL-STD-810 - Environmental Test Methods and Engineering Guidelines.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Ave, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1298	-	Standard Practice for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.
ASTM D 1331	-	Standard Test Method for Surface and Interfacial Tension of Solutions of Surface-Active Agents.
ASTM D 1655	-	Standard Specification for Aviation Turbine Fuels.
ASTM D 2276	-	Standard Test Method for Particulate Contaminant in Aviation Fuel by Line Sampling.
ASTM D 2624	-	Standard Test Method for Electrical Conductivity of Aviation and Distillate Fuels.
ASTM D 3240	-	Standard Test Method for Undissolved Water in Aviation Turbine Fuels.
ASTM D 3948	-	Standard Test Method for Determining Water Separation Characteristics of Aviation Turbine Fuels by Portable Separometer.
ASTM D 5006	-	Standard Test Method for Measurement of Fuel System Icing Inhibitor (Ether Type) in Aviation Fuels.

(Application for copies should be addressed to The American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Materials. Material used shall be in accordance with the manufacturer's materials specifications for filters-coalescer elements, hereinafter referred to as "elements". The materials shall be capable of meeting all of the operational and environmental requirements specified herein. Materials used shall be compatible with petroleum fuels containing water and inhibitors as specified with no evidence of deleterious effect. Materials in contact with test waters shall be corrosion resistant. Zinc or cadmium plating, or use of brass, bronze, and other copper bearing alloys shall not be permitted. Recovered materials should be used to the maximum extent practicable (see 6.7).

3.2.1 Material deterioration, prevention and control. The elements shall be fabricated from compatible materials, inherently corrosion resistant or treated to provide corrosion and deterioration protection for the element's expected service life in any operating and storage environment.

3.2.2 Dissimilar metals. Dissimilar metals shall not be used in intimate contact with each other unless protected against galvanic corrosion.

3.2.3 Identification of materials and finishes. The contractor shall identify the specific material, material finish or treatment for use with component and subcomponent and shall make information available upon request to the contracting officer or designated representative.

#### 3.3 Interface requirements.

3.3.1 Filter-coalescer elements. Elements shall be fabricated and assembled to the form and dimensions shown in figure 1 to insure proper interface and interchangeability with existing filter/separators.

3.3.1.1 End caps. The end caps shall be mounted perpendicular within 3 degrees to the longitudinal axis of the element.

3.3.1.2 O-ring. The O-ring packing and its retaining groove must retain the O-ring seal during installation, and the O-ring shall be in accordance with figure 2 to insure proper interface and interchangeability of the elements with existing filter/separators. The O-ring shall be hydrocarbon fuels (automotive and aircraft types) resistant (see 6.9).

3.3.2 Petroleum fuels and inhibitors. The elements shall satisfactorily process all military aircraft and vehicle fuels, for ground and shipboard use, containing the maximum allowable concentrations of all required and allowed fuel additives at the prescribed flow rates.

3.4 Operating requirements. The filter element shall coalesce water in clear drops from the fuel at a rate of 20 gallons per minute (gal/min) (76 liters per minute (L/min)).

3.4.1 Differential pressure and fiber migration. The differential pressure across the element, in combination with a separator stage (see 6.4.2 and 6.5), when installed in the filter/separator and using

clean fuel (see 6.4.3), shall not exceed 5 pounds per square inch (psi) (34.5 kiloPascals (kPa)) at any flow rate up to 115 percent (%) of rated flow. The element fibers shall not migrate at any rate of flow. The effluent fuel sample shall contain an average of not more than 10 fibers per liter and the number of fibers in any single sample shall not exceed 15 fibers per liter (see 6.4.1). The element shall incorporate sufficient radial support to withstand a differential pressure of not less than 75 (psi) (517 (kPa)) without structural failure or permanent deformation.

3.4.2 Solids removal. The elements when installed in the filter/separator shall remove solids and up to 3 % by volume water at fuel flow rates up to 100 % of rated flow. The effluent fuel samples shall contain not more than 5 parts per million (ppm) by volume of undissolved water when measured with a type II or type III Aqua-Glo water detector in accordance with (IAW) ASTM D 3240. (Report the results to the nearest whole number as ppm of undissolved water in fuel.) The average weight of solids in the effluent fuel samples shall not exceed 0.5 milligram (mg) per liter, and the weight of solids in any single sample shall not exceed 1 mg per liter.

3.4.2.1 Solids removal capacity. The elements when installed in the test filter/separator shall remove and retain a quantity of solids at least equal to 10 grams per gal/min of its rated flow capacity. The pressure differential across the media at rated flow shall not exceed 20 psi (138 kPa) before 30 minutes nor 40 psi (276 kPa) before 70 minutes at a solids injection rate of 0.143 grams per gal/min under the following conditions:

- a. Dry solids.
- b. Solids, inhibited fuel and 3.0 % water mixture.

3.4.3 Water removal. The elements when installed in the filter/separator shall remove water at fuel flow rates up to 115 % of rated flow, with the influent fuel containing water up to 5 % by volume. The effluent fuel samples shall contain not more than 5 parts per million (ppm) by volume of undissolved water when measured with a type II or type III Aqua-Glo water detector in accordance with (IAW) ASTM D 3240. (Report the results to the nearest whole number as ppm of undissolved water in fuel.). The discharge water shall contain not more the 0.5 % fuel by volume.

3.4.4 Life. When specified (see 6.2), the elements when installed in the filter/separator shall remove solid contaminant and water from 0.01 % up to 3 % by volume at rated flow, over a period of 125 hours.

### 3.5 Environmental requirements.

3.5.1 Transit drop. Each filter packaged (see 5.1) shall withstand the shock of being dropped on an 8 inch thick bed of dry sand, from a height of 60 inches by showing no evidence of cracks or deformation of the end caps or damage to filter media.

3.5.2 Storage temperatures. The elements shall withstand storage in temperatures ranging from -50 °F to +160 °F (-46 °C to + 71 °C) after which they shall operate as specified.

3.5.3 Operating temperatures. The elements when installed in the filter/separator shall permit rated flow when operating in ambient temperatures ranging from -25 °F to 140 °F (-32 °C to +60 °C).

3.5.4 Fuel and salt water immersion. The elements after being immersed in test fuel for 100 hours and after immersion in salty water for 72 hours, shall show no evidence of swelling, corrosion, separation of components, dissolving of adhesives, or deformation which could cause failure during operation.

3.5.5 Post-environmental testing. Unless otherwise specified (see 6.2), the elements when installed in the filter/seperator shall remove water at rated flow, with the influent fuel containing water of 0.01 % by volume for 30 minutes. The effluent fuel samples shall contain not more than 5 parts per million (ppm) by volume of undissolved water and an average of not more than 10 fibers per liter and the number of fibers in any single sample shall not exceed 15 fibers per liter

### 3.6 Support and ownership requirements.

3.6.1 Identification marking. Filter marking shall include, as a minimum, the following information permanently marked or stamped on the filter:

- a. NSN: 4330-00-983-0998 for elements
- b. Contract or Order No.: (Specify)
- c. Lot: (Specify)
- d. MANUFACTURER'S IDENTIFICATION: (Specify)
- e. DATE OF MFG: (Specify)

3.6.2 Workmanship. The elements shall be free from burrs, tears, smudges, or any other defect that will impair serviceability.

## 4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 First article inspection. The contractor shall furnish 32 filters to determine conformance to this specification (see 6.2). First article inspection shall be conducted as specified in 4.3.3.1 and 4.5. Presence of one or more defects or failure of any test shall be cause for rejection.

### 4.3 Conformance inspection.

4.3.1 Lot. Unless otherwise specified (see 6.2), a lot shall consist of not more than 1,000 filters, identically produced by one shift during a single day.

4.3.2 Sampling. Sampling for examinations and tests shall consist of 16 filters selected at random from the first day's production, two filters selected at random from each lot after the first day's production and four additional samples selected at random for each resubmitted lot. Sample filters tested as specified in 4.2 and 4.3.4 shall be discarded and not be delivered as production items.

4.3.3 Examination. Samples selected in accordance with 4.3.2 shall be examined as specified in 4.3.3.1. Presence of one or more defects or failure of any test shall be cause for rejection.

4.3.3.1 Examination procedure. The elements shall be examined as specified herein for the defects specified in table I.

TABLE I. Classification of defects.

Category	Defect	Method of Examination
Critical	None	
Major:		
101	Material not as specified (see 3.2).	Visual
102	Material not resistant to corrosion and deterioration or treated to be made resistant to corrosion and deterioration (see 3.2.1).	Visual
103	Dissimilar metals (see 3.2.2).	Visual
104	The design of the filter not as specified (see 3.3).	Visual
105	Dimension not as shown in figure 1 (see 3.3.1).	Visual
106	O-Rings in ends of filter missing or damaged (see 3.3.1 and 3.3.1.1).	Visual
107	End caps mounting not as specified (see 3.3.1.2).	Visual
108	Elements adversely affected by and have an effect upon fuels and inhibitors(see 3.3.2).	Visual
109	Identification marking incorrect, missing or illegible (see 3.5).	Visual
110	Workmanship not as specified (see 3.6).	Visual

4.3.4 Tests. Samples selected in accordance with 4.3.2 shall be tested as specified in 4.5.1, 4.5.3 and 4.5.4. Failure of any sample to pass the tests shall be cause for rejection of the lot represented by the sample.

4.4 Inspection conditions. The fuel flow rate shall be 20 gal/min (76 L/min) per element, 100 % of rated flow per element, except where otherwise specified.

4.4.1 Test facility. Appendix A describes an acceptable facility and general requirements for testing the elements. The manufacturers testing facility shall be subject to approval by the Government. The facility shall contain calibrated and certified measuring equipment.

4.4.2 Test fuels. Appendix A describes an acceptable test fuel and general requirement for adding the inhibitors. The manufacturers test fuel shall be subject to approval by the Government.

4.4.3 Fuel temperature. Unless otherwise specified (see 6.2), the test fuel temperature shall be between 40 °F to 90 °F (4°C to 32 °C) during testing. The test fuel temperature shall be maintained within plus or minus 5 °F (3 °C) of the starting temperature for any individual test.

4.4.4 Test contaminants. The following contaminants shall be used.

4.4.4.1 Solid contaminant. The solid contaminant shall consist of a mixture of 90% (by weight) ultrafine test dust and 10% (by weight) red iron oxide (see 6.8).

4.4.4.2 Water contaminant. Fresh water shall contain less than 1.0 mg/liter of solids and shall have a surface tension of not less than 65 dynes/cm at 75 °F (24 °C). The acidity-alkalinity value (pH) shall be between 5 and 8.

4.4.5 Test data. The test data sheets shall be provided. Figure 3 is an example of a typical test report format.

4.4.6 Test sampling schedule and procedures. Test sampling schedule and procedures shall be in accordance with table II.

TABLE II. Test sampling schedule and procedures.

Test	Test Para.	When samples are taken	Sample size	Purpose	No. of samples	Analysis Para.	Sampling point	Type of sample
Differential pressure and media migration	4.5.2	At start	500 ml water	IFT of water	1	4.4.7.8	Water filter effluent	Sample bottle
		At start	4000 ml fuel	IFT and WSIM, fuel	1	4.4.7.5 4.4.7.9	Fuel storage tank	Sample bottle
		5, 10 and each 10 min. thereafter	1000 ml	Solids (media)	7	4.4.7.2	Test F-S effluent	In-line sampler
		5, 10 and each 10 min. thereafter	One quart	Fiber determination	7	4.4.7.4	Test F-S effluent	Sample bottle
Solids (dry)	4.5.3	5, 10 and each 10 min. until 40 psi, then at 5 psi intervals until 75 psi	1000 ml	Element, integrity, solids	8 min	4.4.7.2	Test F-S effluent	In-line sampler
Water/solids removal	4.5.4a	At start, before water injection, every 10 min. thereafter	500 ml	Free water in fuel	7	4.4.7.1	Test F-S effluent	In-line sampler
	4.5.4b	At start, before water injection, every 10 min. thereafter	500 ml	Free water in fuel	6	4.4.7.1	Test F-S effluent	In-line sampler
	4.5.4c	5, 10 and each 10 min. thereafter until 40 psi	500 ml and 1000 ml	Solids, water removal, diff. press.	8 min	4.4.7.1 4.4.7.2	Test F-S effluent	In-line sampler
	4.5.4d	5, 10, 20 and 30 min. and last 15 min.	500 ml and 5-gal	5 % water removal, fuel in sump discharge	5	4.4.7.1 4.4.7.11	Test F-S effluent and sump	In-line sampler, 5-gal carboy
Life	4.5.5b	Every 10 min. of each water add period	500 ml	Water removal	6	4.4.7.1	Test F-S effluent	In-line sampler
	4.5.5c	1 min., 15 min. and 8 hrs. At beginning and end of each 8 hr period thereafter, and during the last 5 min.	1000 ml, 500 ml and quart	Free water, solids and fibers	32	4.4.7.1 4.4.7.3 4.4.7.4	Test F-S effluent	In-line sampler, sample bottles

#### 4.4.7 Analysis of samples.

4.4.7.1 Free water detector, viewer kit. To analyze for the presence of free water in effluent fuel, a free water detector viewer kit conforming to ASTM D 3240 shall be used.

4.4.7.2 Solid contaminants. Effluent fuel samples shall be collected and analyzed in accordance with the method and procedures specified in ASTM D 2276. Samples shall be collected for analysis starting five minutes and 10 minutes after solids injection has started, and every 10 minutes thereafter until a differential pressure of 40 psi is reached, then at each five psi increment to the end of the solids injection period, or five minutes after a differential pressure of 75 psi has been reached. The amount of solids in the effluent fuel measured by the method described in ASTM D 2276 shall be the determining factor as to conformance or nonconformance to solids limitations.

4.4.7.3 Solids and water contaminants. When solid and water contaminants are injected simultaneously, or one immediately following the other during a test, samples for solids determination shall be collected by the same method and on the same schedule as specified in 4.4.7.2. Samples for determination of free water shall be in accordance with 4.4.7.1, and shall be collected at the same time, or immediately after the samples being collected for solids determination. The method specified in 4.4.7.2 shall be the determining factor for conformance or nonconformance to solid limitations, and the method specified in 4.4.7.1 shall be the determining factor for conformance or nonconformance to free water limitations. The results from samples collected during or immediately following a stop/start cycle in any test series shall not be used to determine conformance or nonconformance to any contaminant limitation. Wait a minimum of one minute after completion of a stop/start cycle before recording a fuel quality monitor reading or collecting a sample to determine conformance.

4.4.7.4 Fiber determinations. The analysis for fibers in the effluent fuel samples shall be in accordance with appendix B of this specification.

4.4.7.5 Water separometer index, modified (WSIM). The WSIM test shall be performed in accordance with (IAW) ASTM D 3948 (Mode A).

4.4.7.6 Icing inhibitor. The concentration of icing inhibitor in the fuel shall be determined IAW ASTM D 5006

4.4.7.7 Corrosion inhibitor. The concentration of DCI-4A shall be determined in accordance with MIL-PRF-25017.

4.4.7.8 Interfacial tension (IFT). The IFT determination shall be performed IAW ASTM D 1331, Method B. Each fuel sample tested shall be run separately over distilled water and over injected water.

4.4.7.9 Surface tension. The surface tension of the water shall be performed as specified in ASTM D 1331, Method A.

4.4.7.10 pH determination. The pH of the water shall be determined by using a direct reading instrument such as a Leeds and Northrup Model 7401 pH meter or equivalent instrument having calibrated accuracy of plus or minus 0.1 pH.

4.4.7.11 Fuel in discharge water. The 5-gallon sample drawn from the filter/separator sump during the last 15 minutes of the five-percent water run, shall be allowed to settle for a period of 24 hours prior to determining the volume of fuel.

4.4.7.12 Electrical conductivity additive determination. The electrical conductivity of the test fuel shall be determined by the method described in ASTM D 2624.

4.4.7.13 Specific gravity. The specific gravity of the test fuel shall be determined by the method described in ASTM D 1298.

#### 4.5 Methods of inspection.

4.5.1 Operation. To determine conformance to 3.4, the element shall be subjected to the following test:

- a. Equipment: An open tank of uninhibited test fuel, a pump, pressure gage, piping or flexible hose, valves, fixture for retaining the element, a metered supply of tap water, and a water drain are required for this test. The retaining fixture shall mechanically support and seal the ends of the element in the same manner as the vessel for which the element is intended, and shall direct the flow in the normal direction (inside-to-outside) through the element. A schematic arrangement of the element test equipment is shown in figure 4.

Failure of this test by two or more elements from the same lot may cause rejection of that lot.

- b. Procedure: The test shall conducted as follows:

1. Submerge mounted element in the fuel.
2. Start fuel flow and gradually increase flow rate, expelling all air, until 100 % rated flow is reached.
3. Inject water at 10 % of rated flow until water drops are formed on the element.
4. Rotate the element and observe the water drops and test fuel. The formation of clusters of water drops, graping, or streams, or uncoalesced water droplets shall constitute failure of this test.

4.5.2 Differential pressure and filter migration. To determine conformance to 3.4.1 and prior to installation of the elements, the test fuel shall be pumped through the test filter/separator at the flow rates shown in table III. The differential pressure values obtained shall be used as the pressure drop across the filter/separator housing without the element installed. After completion of this portion of the test, the new, dry element shall be installed in the test filter/separator and subjected to the flow tests at the flow rates shown in table III. The differential pressures obtained shall be used as the pressure drop across the filter/separator housing with the element installed. Fuel samples shall be collected in accordance with table II to determine the amount of filter migration.

TABLE III. Rate of flow for 60 minutes.

Period	Time (minutes)	Percent of rated flow
1	0 to 10	100
2	10 to 20	80
3	20 to 30	60
4	30 to 40	40
5	40 to 50	20
6	50 to 60	115

4.5.3 Solids (dry). To determine conformance to 3.4.1, 3.4.2 and 3.4.2.1, dry solid shall be continuously added into the test fuel at a rate of 0.143 grams per gal/min of fuel being circulated until 75 psi differential pressure is reached across the elements. At the end of 80 minutes, if 75 psi differential pressure has not been reached, the rate of addition may be increased to 0.4 grams per gal/min. The 75 psi differential pressure shall be maintained for a period of five minutes. Following this test, the test filter/seperator shall be opened and examined. Evidence of structural failure of the elements shall constitute failure of this test.

4.5.4 Water/solids removal (new set of elements). The same set of elements shall be used in all of the following tests. At the midpoint of each of the tests, the fuel flow shall be stopped, by closing a quick-closing valve located downstream from the effluent sampling connection. The fuel flow shall be immediately reestablished and the test continued after each stop/start cycle.

- a. 0.01 % water injection rate at 115 % of rated flow for 60 minutes.
- b. 1.0 % water injection rate at 100, 80, 60, 40, 20 and 115 % of rated flow for 10 minutes at each flow rate.
- c. Increase to 3.0 % water injection rate at 100 % of rated flow and start adding solids at 0.143 grams per gal/min of rate flow for 70 minutes. The pressure differential across the elements shall not exceed 20 psi (138 kPa) before 30 minutes nor 40 psi (276 kPa) before 70 minutes.
- d. At the end of 70 minutes, stop the solid injection and increase the water injection rate to five % at 115 % of rated flow for 30 minutes.

Nonconformance to 3.4.2, and 3.4.2.1 and 3.4.3, as applicable, shall constitute failure of these tests.

4.5.5 Life (new set of elements). To determine conformance to 3.4.4, test fuel shall be pumped through the test filter/seperator at rated flow with the test elements and the separators installed for 125 hours. Nonconformance to 3.4.2, 3.4.2.1, and 3.4.3, shall constitute failure of this test.

- a. The life test may be accomplished in a maximum of 16 operating increments of eight hours per day for 15 consecutive workdays and a final operating increment of five hours on the 16th workday. Startup and shutdown of the test shall be accomplished by starting and stopping the pump.

- b. Water shall be injected at the beginning of each increment for one hour. The water injection rate shall be 0.01 %, except for the final (125th) hour, during which time the water injection rate shall be increased to 0.5 %.
- c. Solid shall be added dry at the rate of 0.143 grams per gal/min of flow rate at the beginning of each increment as required to produce and maintain a pressure differential of 10 psi across the test filter/seperator. The start of the test dust addition, if required, shall be immediately after the start of the water injection.

4.5.6 Environmental. The environmental tests shall be conducted in the following order. The same complete set of elements shall be used for each environmental test. In addition, any materials of construction that may be a possible cause of fuel contamination shall be subjected to these environmental tests.

4.5.6.1 Transit drop. To determine conformance to 3.5.1, each filter contained in their unit package shall be dropped on an 8-inch thick bed of dry sand, from a height of 60 inches. All drops shall be made so that the element falls freely through the distance specified. The element shall be dropped eight times, four on each end of the unit package. Cracks or deformation of end caps, damage to filter media shall constitute failure of this test. NOTE: At the discretion of the Government test activity, this test may be omitted from conformance testing to include only those element being subject to first article inspection.

4.5.6.2 Storage, high temperature. Test the elements in accordance with MIL-STD-810, method 501.3, procedure I, steps 1 thru 6. Storage temperature shall be as indicated for hot, induced conditions. Nonconformance to 3.5.2 shall constitute failure of this test.

4.5.6.3 Operation, high temperature. Install the elements into the test filter/seperator. Operate the filter/seperator at rated flow at an ambient temperature of plus 140 °F (60 °C) for a period of not less than one hour. Nonconformance to 3.5.3 shall constitute failure of this test.

4.5.6.4 Storage, low temperature. Test the elements in accordance with MIL-STD-810, method 502.3, procedure I, steps 1, 2, 3, 6 and 7. Storage temperature shall be minus 50 °F (-46 °C). The storage temperature shall be maintained for four hours. Nonconformance 3.5.2 shall constitute failure of this test.

4.5.6.5 Operation, low temperature. Install the elements into the test filter/seperator. Operate the filter/seperator at rated flow in an ambient temperature of minus 25 °F (-32 °C) for a period of not less than one hour. Nonconformance to 3.5.3 shall constitute failure of this test.

4.5.6.6 Resistance to fuel. Immerse the elements in the test fuel for a minimum period of 100 hours at a temperature of 77 °F (25 °C) plus or minus 5 °F (3 °C), and examine for defects. Nonconformance to 3.5.4 shall constitute failure of this test.

4.5.6.7 Resistance to salt water. Immerse the elements in a solution consisting of four percent sodium chloride and 96 percent distilled water for a period of 72 hours and examined for defects. Nonconformance to 3.5.4 shall constitute failure of this test.

4.5.6.8 Post-environmental performance. Install the same elements in the test filter/seperator and subject these elements to the 0.01 % water removal test for 30 minutes at 100 % of rated flow using inhibited fuel, at a minimum test fuel temperature of 40 °F (5 °C). Nonconformance to 3.5.5 shall constitute failure of this test.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The elements are intended for use in military filter-separator vessels to remove solid contaminants and to coalesce water from gasoline, diesel, and jet fuels. The elements covered by this performance specification are military unique because they must be able to operate satisfactorily at temperatures ranging from minus 25 °F to 140 °F and interface with the family of military standard filter/separators. Commercial elements are not designed to withstand such extreme and sudden operating environmental conditions and their elements are 6 inches in diameter, where as the military element is 3.75 inches in diameter.

6.2 Acquisition data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).
- c. If first article inspection is required (see 3.1 and 4.2) and the number of samples.
- d. If life test is required (see 3.4.4).
- e. If post environmental test is required (3.5.5).
- f. When lot size other than as specified (see 4.3.1).
- g. When test fuel temperature is other than as specified (see 4.4.3).
- h. Selection of applicable level and packaging and packing requirements (see 5.1).
- i. Test fuel required (see A.2.1.1, Appendix A).

6.3 Disposition of test assemblies. Filters undergoing destructive tests should be indelibly marked "DO NOT USE".

#### 6.4 Definitions.

6.4.1 Fiber. A fiber is defined as any particle with a length-to-diameter ratio of ten to one, or more, and a length of 100 microns or more.

6.4.2 Differential pressure across the element. The differential pressure across the element is defined as the pressure drop across the filter/separator with the element installed measured from the fuel inlet coupling to the fuel outlet coupling (excluding accessory valves), less the pressure drop across the filter/separator without the element installed.

6.4.3 Clean fuel. Clean fuel is defined as fuel containing not more than 0.5 mg per liter of solid contamination and no free water, or an irreducible minimum amount of free water, as indicated by the test system fuel quality monitors or devices specified herein, while circulating the test fuel through the test loop prior to the start of testing.

6.5 Separator stages. Satisfactory performance of filter/separators utilizing the elements cited in 3.4.1, has been based on the use of water-removing separators that physically strips the coalesced water droplets from the flowing fuel stream. The vertical filter/separators used by the military utilize a cylindrical canister (separator) that surrounds each element and contains a 100-mesh monel screen coated with polytetrafluoroethylene, a hydrophobic material. Drawings 13216E2773 and 13217E6316 are provided for guidance only.

#### 6.6 Subject term (key word) listing.

Coalescer  
Filter element  
Filter-separator  
Fuel

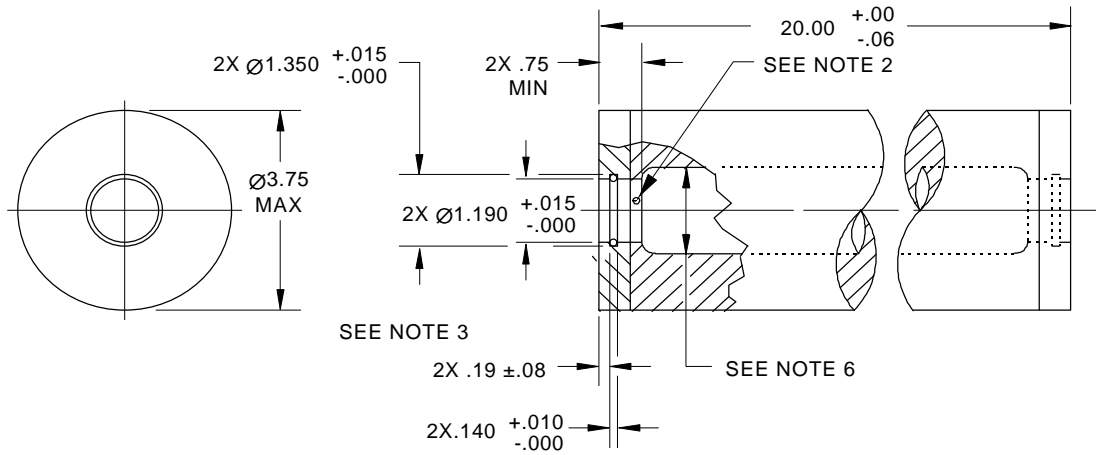
6.7 Recovered materials. For the purpose of this requirement, recovered materials are those materials which have been collected from solid waste and reprocessed to become a source of raw materials, as distinguished from virgin raw materials. The components, pieces and parts incorporated in the element may be newly fabricated from recovered materials to the maximum extent practicable, provided the element produced meets all other requirements of this specification. Used, rebuilt or remanufactured components, pieces and parts will not be incorporated in the element.

6.8 Solid contaminants The solid contaminants can be obtained from the following manufacturers.

- a. Red iron oxide, obtainable from Harcros Pigments Inc., 2001 Lynch Avenue, East St. Louis, IL 62205, identified as Coppras Red Iron Oxide no. R9998.
- b. A1 Ultrafine Test Dust ISO 12103-1, obtainable from Powder Technology Inc., P.O. Box 1464, Burnsville, MN 55337.

6.9 Hydrocarbon fuel resistant O-rings. Historically the hydrocarbon fuel resistant O-rings were manufactured to in accordance with MS29513-123.

6.10 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.



NOTES:

1. DIMENSIONS ARE INCHES.
2. THIS AREA TO BE LEFT FREE FROM FILTER ELEMENT MATERIAL, BOTH ENDS.
3. PROVIDE O-RING IN EACH END GROOVE.
4. APPLY LIGHT COATING OF SILICONE COMPOUND TO O-RING GROOVES AND O-RING.
5. FLOW SHALL BE FROM INSIDE TO OUTSIDE.
6. INSIDE DIAMETER AND CONFIGURATION ARE OPTIONAL.
7. REFERENCE: FOR USE WITH 1.182-1.187 MALE GLAND AT 100 PSI MIN, BOTH ENDS.
8. NOMINAL RATE OF FLOW IS 20 GPM.
9. REFERENCE: NSN 4330-00-983-0998.

FIGURE 1. Filter-coalescer element.

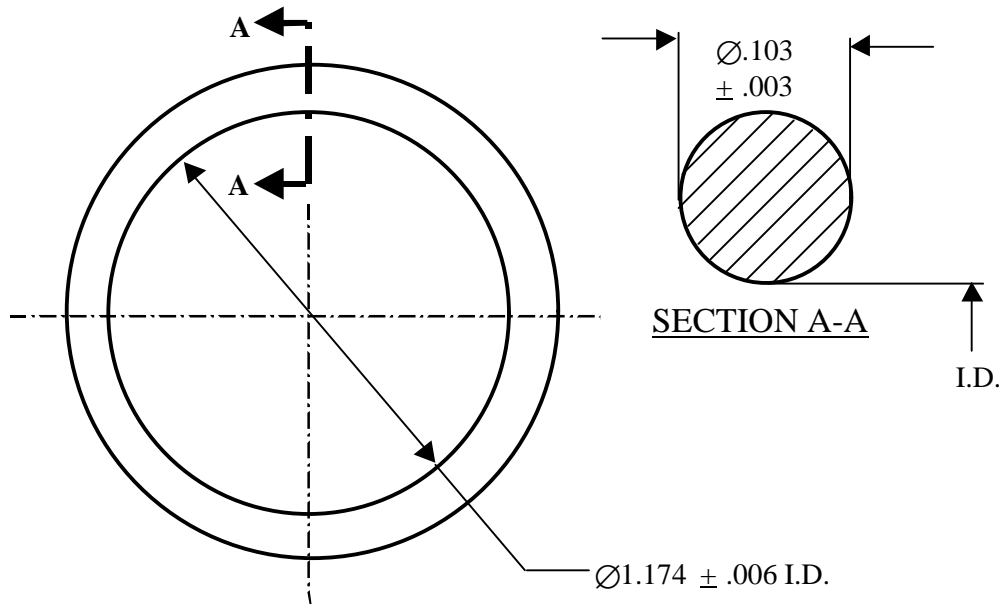


FIGURE 2 O-ring size and geometry.

<b>Test:</b>							<b>Test Date:</b>					
Test Unit: _____							Test Engineer: _____					
_____							Witnesses: _____					
_____							_____					
_____							_____					
Time (minutes)	Fuel Flow Rate (gal/min)	Test Unit Δ P (psi)	Fuel Temp. (°F)	Conductivity (pS/m)		Water Addition Rate (%)	Solids Addition Rate (mg/ gal/min)	Pressure Inlet	Pressure Outlet	Free Water (ppm)	Total Solids (mg/L)	Remarks
				Influent	Effluent							

Water Surface Tension:

Corrosion Inhibitor Added:

Water pH Value:

FSII Added:

Fuel in Sump Discharge Water:

Electrical Conductivity Added:

WSIM Before Additives:

WSIM After Additives:

FIGURE 3. Test report form. – Example

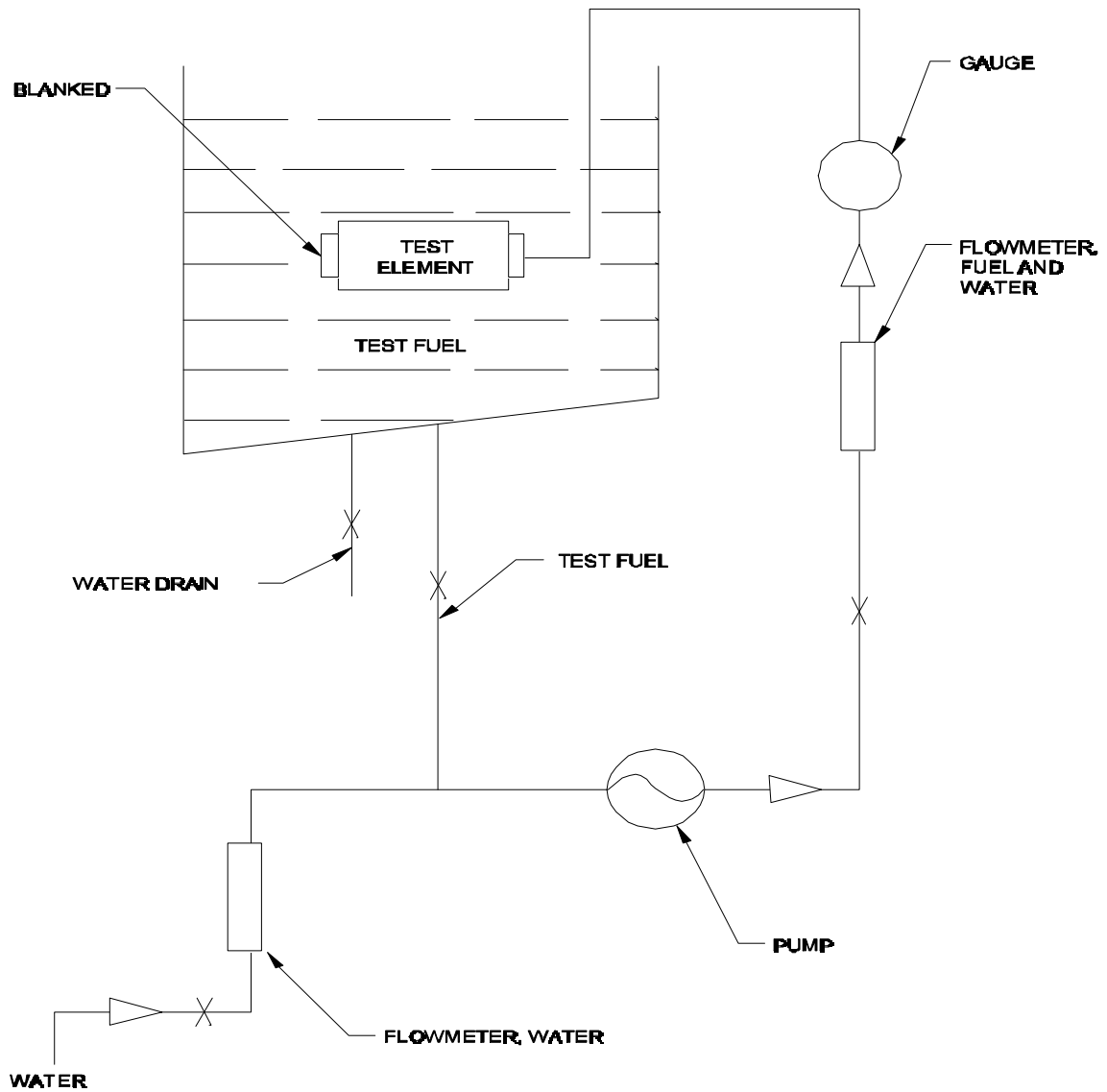


FIGURE 4. Filter-Coalescer Element Test Equipment

APPENDIX A

TEST FACILITY AND TEST FUEL

A.1 SCOPE

A.1.1 Scope. This appendix describes an acceptable facility for testing Filter-Coalescer Elements and acceptable mixture of fuel and inhibitors. The following are general requirements and guidance for the test facility. This appendix is not a mandatory part of this specification. The information contained herein is intended for guidance only.

A.2 APPLICABLE DOCUMENTS

A.2.1 Government documents.

A.2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks of the exact revision listed below form a part of this specification to the extent specified herein.

MIL-PRF-5624            - Turbine Fuel, Aviation, Grades JP-5, JP-5, and JP-5/JP-8 ST

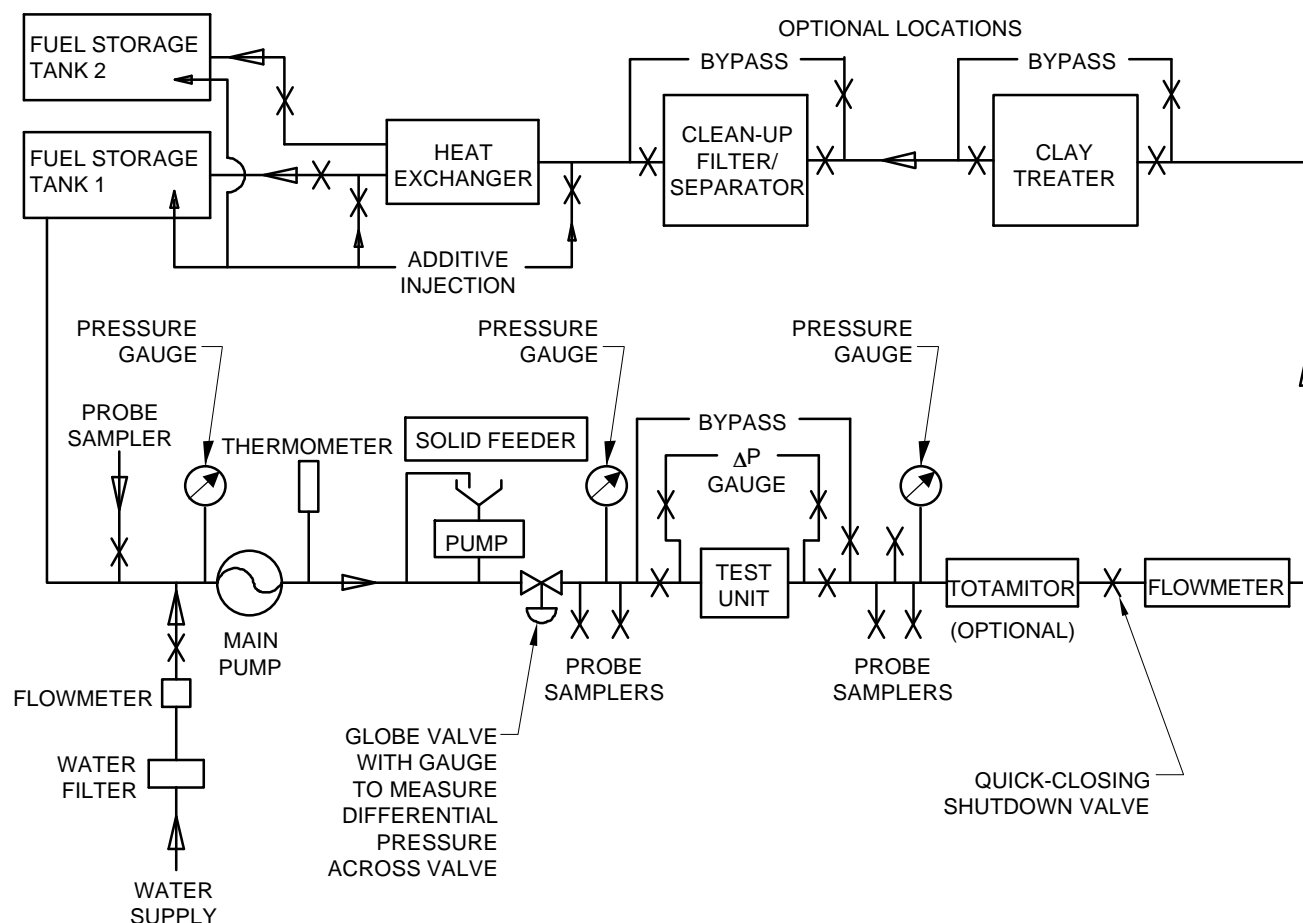
A.2.2 Non-Government publications. The following documents of the exact revision listed below form a part of this document to the extent specified herein.

ASTM D 4171            - Standard Specification for Fuel System Icing Inhibitors

A.3 PROCEDURE

A.3.1 Test loop system. Arrangement of the test loop system will be as shown in figure 5 and as specified herein. Materials used in the test loop will be compatible with the test fuels. Tests using this test loop system will be conducted in the single pass mode.

## APPENDIX A

FIGURE 5. Test facility. – Example

A.3.1.1 Instruments. Instruments such as meters and gages used in the test loop system will be of laboratory precision type and will be calibrated at intervals spaced to assure laboratory accuracy. The use of transducers connected to a data acquisition system/microprocessor is allowed.

A.3.1.2 Main pumping unit. The main circulating pump will be a Worthington model 1-1/2 U, two stage with two 7-1/4 inch impellers or equal.

#### A.3.1.3 Flowmeters.

A.3.1.3.1 Fuel flowmeter. A meter will be provided to indicate the specified fuel flow within an accuracy range of one percent at rated flow.

A.3.1.3.2 Water flowmeter. A meter will be provided to indicate the flow rate of the water added to the fuel as a contaminant. The flowmeter accuracy range will be within plus or minus two percent of the specified water flow rate.

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A.3.1.4 Solid contaminant feeder. A continuous solid contaminant feeder with an accuracy range within plus or minus one percent of the specified feed rate will be provided to feed the solid contaminant into the test loop system.

A.3.1.5 Filter/separators.

A.3.1.5.1 Test filter/separator. The test filter/separator will be a vertical four-element, 50-gal/min filter/separator, similar to the military-design filter/separator, that has successfully passed all Government test requirements using separators (canisters) similar to the military-design canisters. Performance and structural integrity will not be affected by the examination, tests, and handling specified in this specification. Only two elements are used in each test leaving two inlets open. These two inlets will be blocked off prior to starting the test. Canisters will be installed on all four inlets to maintain even velocity throughout the vessel.

A.3.1.5.2 Clean up filter/separator. The clean up filter/separator and media used therein will be of a type that has successfully passed all tests specified in this specification and will be capable of processing fuel at not less than 115 % of the system flow rating.

A.3.1.6 Clay treater. A commercial clay treater assembly will be used to remove residual fuel system additives as required. The clay treater will be bypassed or removed from the test loop during testing (see figure 5).

A.3.1.7 Differential and other pressure gages. Pressure gages will be provided for installation in the test loop system. One differential pressure gage will indicate the pressure drop across the test filter/separator. Three additional pressure gages will indicate pressure readings at various locations in the test loop as shown in figure 5. The accuracy of the gages will be such that any error will not exceed plus or minus two psi.

A.3.1.8 Water filter. A water filter will be provided for filtering the water used as a contaminant to the cleanliness specified in 4.4.4.2.

A.3.1.9 Heat exchanger. When required by the ambient temperature, one or more heat exchanger will be installed in the test loop, as shown in figure 5, to control test fuel temperature.

A.3.1.10 Sampling devices. Probe-type sampling devices, figure 6, facing upstream, will be installed in the test loop as shown in figure 5, within 10 pipe diameters of the test filter/separator outlet or inlet.



## APPENDIX A

A.3.1.12 Test system piping. The flow system piping between the pump and the filter/separator effluent sampling point will provide for a minimum fluid velocity of six feet per second at the rated flow of the test unit. Solids will be injected as close as practicable to the test filter/separator, and will not be passed through the main circulating pump. Water contaminant injection piping will be connected to the suction side of the main circulating pump.

A.3.1.13 Test system pressure. The test loop system pressure will be not less than 20 psi when measured at the sampler just downstream from the test filter/separator during the tests specified herein under all flow conditions.

A.3.2 Test fuels. Jet A or Jet A-1 fuel conforming to ASTM D 1655 or JP-5 fuel conforming to MIL-PRF-5624 will be used for all tests (see 6.2). The fuels specified herein will not be commingled.

A.3.2.1 Pre-Conditioning.

a. During pre-conditioning, the test filter/separator will be bypassed.

b. The test fuel will be circulated through a clay treater filled with Fuller's earth or replaceable clay cartridges to absorb any residual fuel system additives or refinery residuals. The fuel will be circulated at a flow rate not to exceed 50 % of the rated capacity of the clay treater. The fuel will be suitable for testing when the interfacial tension (IFT) is above 40 dynes/cm as measured between the test fuel and test water, and the water separometer index, modified (WSIM) of the test fuel is not less than 95. The specific gravity (SG) of the test fuel will not be lower than 0.775 or higher than 0.845. Samples of test fuel for analysis will be obtained from the fuel storage tanks or upstream from the test filter/separator.

c. The test fuel will also be circulated through the cleanup filter/separator, and back to the storage tank. The test fuel will be circulated until the fuel quality indicates that 1) free water in the test fuel has been reduced to zero or some irreducible minimum value that remains stable, and 2) does not contain more than 0.5 mg/L of solids. These background values for free water and solids will be subtracted from all subsequent free water and solids reading recorded after testing starts to obtain the net contaminant readings.

A.3.2.2 Additives.

a. During the injection of fuel additives, all filtration equipment will be bypassed.

b. The additives will not be premixed or injected simultaneously. The additives will be injected into the main pump suction line, through the contaminant injection equipment, or at a storage tank opening. The additives may be pre-diluted with test fuel if necessary to achieve the required injection rate.

c. Each additive will be introduced into the fuel system at a rate equal to the ratio of the final fuel blend desired. For example, the fuel requires 0.19 pounds per 1000 gallons of DCI-4A, and if the fuel is circulated at 300 gal/min, the inhibitor will be introduced at 0.057 pounds (25.85 grams) per minute. The fuel requires 0.20 % by volume of fuel system icing inhibitor, and the fuel is circulated at 300 gal/min, the fuel system icing inhibitor will be introduced at 0.6 gallons (2.27 liters) per minute.

APPENDIX A

d. The additives will be blended into the test fuel at the concentrations and in the order described below:

1. Stadis<sup>®</sup> 450, marketed by Octel America, Inc., will be added to the test fuel to achieve an initial concentration of 0.0167 pounds per 1000 gallons (2 mg/L) before the other additives. If the fuel conductivity measures less than 150 pico Siemens per meter (pS/m), an additional amount of Stadis<sup>®</sup> 450 will be added to establish a fuel conductivity within the range of 150-600 pS/m. To ensure proper mixing three successive conductivity readings taken 10 minutes apart will be within plus or minus 10 pS/m in accordance with ASTM D 2624.

2. Fuel system icing inhibitor conforming to ASTM D 4171, Type III will be added to the test fuel to achieve an initial concentration of 0.20 % by volume.

3. The DCI-4A corrosion inhibitor conforming to MIL-PRF-25017 will then be added to the fuel to achieve an initial concentration of 8.0 pounds per 1000 barrels or 0.19 pounds per 1000 gallons (22.8 mg/L).

4. Pentronate L, marketed by Witco Chemical, will be added to the fuel to achieve an initial concentration of 0.00334 pounds per 1000 gallons (0.4 mg/L).

e. Following introduction of the additives, the test fuel will be circulated through the test loop, bypassing all filtration equipment, until two fuel system turnovers have been completed, to ensure complete mixing of the test fuel prior to start of testing.

APPENDIX B

FIBER DETERMINATION METHOD

B.1 SCOPE

B.1.1 Scope. This appendix details the method to be used for determining the number of fibers present in a 1000 ml sample of test fuel. The number of fibers present needs to be known in order to determine if a test item is functioning within the limits of this specification. This Appendix is not a mandatory part of the specification. The information contained herein is intended for guidance only.

B.2 APPLICABLE DOCUMENTS

(This section is not applicable to this appendix.)

B.3 APPARATUS

B.3.1 Apparatus. This following apparatus is required:

- (a) Millipore Fluid Sample Kit, Cat. No. XX64 037 00 (or equal).
- (b) Millipore Field Monitors, Particle Size Analysis, Cat. No. MAWG037P0 (or equal).
- (c) Vacuum pump.
- (d) Oven for obtaining 194 °F (90 °C).
- (e) Calibrated microscope capable of examining fibers.

B.4 PROCEDURE.

B.4.1 Withdraw a 1000 ml sample through a pre-counted monitor (see note) in accordance with fluid sampling kit operating instructions. Sample will be taken at the sampling site immediately after the solid feeder pump and will be called the upstream monitor sample. Withdraw another 1000 ml sample through a pre-counted monitor at the sampling site immediately after the test vessel. This sample will be called the downstream monitor sample.

B.4.2 Remove excess fuel from monitors with a vacuum pump. Dry monitors intact in an oven for 1 hour at 194 °F (90 °C) plus or minus 5 °F (3 °C) with the inlet/outlet plugs removed. Cool monitors.

B.4.3 Count fibers on each monitor filter pad with a calibrated microscope, capable of examining fibers. Subtract upstream monitor sample from downstream monitor sample to obtain a net fiber count.

NOTE: Pre-count monitor to obtain a background fiber count blank. Subtract background fiber count blank from each monitor used. If Millipore monitors are used, average background counts are indicated on each carton of assembled Contamination Analysis Monitors. Pre-counting can be eliminated by using the average background fiber count as a blank.

Custodians:

Army - AT  
Navy - AS  
Air Force – 11

Preparing activity:

Army - AT

(Project 4330-0150)

Review activities:

Army - AV  
Navy - MC  
Air Force - 99  
DLA - CC

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

### I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER  
MIL-PRF-52308H

2. DOCUMENT DATE (YYMMDD)  
981123

### 3. DOCUMENT TITLE

FILTER-COALESCER ELEMENT, FLUID PRESSURE

### 4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

### 5. REASON FOR RECOMMENDATION

### 6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*

b. ORGANIZATION

c. ADDRESS *(Include Zip Code)*

d. TELEPHONE *(Include Area Code)*  
(1) Commercial  
(2) AUTOVON  
*(If applicable)*

7. DATE SUBMITTED  
(YYMMDD)

### 8. PREPARING ACTIVITY

a. NAME

b. TELEPHONE *(Include Area Code)*  
(1) Commercial (810) 574-8745  
(2) AUTOVON 786-8745

c. ADDRESS *(Include Zip Code)*  
Commander  
U.S. Army Tank-automotive and Armaments Command  
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5203 Leesburg Pike, Suite 1403  
Falls Church, VA 22041-3466  
Telephone (703) 756-2340 AUTOVON 289-2340

## SUMMARY OF CHANGES

### Project Number

4330-0150

### Document Number

MIL-PRF-52308H; Filter-Coalescer  
Element, Fluid Pressure

1. General. This Performance Specification is based on the requirements in MIL-PRF-52308G, dated 23 November 1995 and MIL-F-8901E, dated 6 June 1980. The Performance Specification format is based on MIL-STD-961D and the AMC BRTRC format.

### 2. Detailed changes.

- a. Figures are moved and rearranged as appropriate. These changes are made in respect to the MIL-STD-961D format.
- b. Made random grammatical changes through out the document partially from erroneous typos and violations of the MIL-STD-961D.

c. SCOPE (no changes).

### d. APPLICABLE DOCUMENTS

- 1. Removed MS29513, *Packing, Preformed, Hydrocarbon Fuel Resistant O-Ring*, and incorporated the specific o-ring size (MS29513-123) needed for the Filter-Coalescer Element, Fluid Pressure. By viewing historical versions of the document, only the one specific size is needed for this performance specification. In addition, performance specifications should not site MS drawings per MIL-STD-961D, paragraph 4.21, section d, part 4 (page 19).

### e. REQUIREMENTS

- 1. (See section a. and b.)

### f. VERIFICATION

- 1. (See section a. and b.)

g. PACKAGING (no changes).

## SUMMARY OF CHANGES (CONTINUED)

### h. NOTES

1. Moved the different paragraphs in section 6 and placed them their respectively chronologically correct order via the MIL-STD-961D, paragraph 5.3.6 through 5.3.6.15 (page 38 through 42).

### i. APPENDIXES

1. Changed the numbering and lettering method for Appendix A and B to meet the MIL-STD-961D, paragraph 5.5.3 (page 44).
2. Installed the correct ending (boilerplate) of A.1.1 (and B.1.1) “*Scope*”. This was done to follow the MIL-STD-961D, paragraph 5.5.6 (page 44).